AMENDED NEW SET OF CLAIMS

1. A piezoelectric thin film device comprising a substrate having a vibration space, and a piezoelectric laminated structure formed on an upper surface side of the substrate, the piezoelectric laminated structure including a piezoelectric film and electrodes formed respectively on both surfaces of the piezoelectric film, and the vibration space being formed so as to allow a vibration part to vibrate, the vibration part including at least a part of the piezoelectric laminated structure, wherein the vibration space is constituted by a first via hole formed from a lower surface of the substrate toward an upper surface thereof with an intermediate surface formed at an intermediate position in the substrate, and a second via hole formed from the intermediate surface toward the upper surface of the substrate, the second via hole being positioned inside the first via hole when viewed in a vertical direction.

2. The piezoelectric thin film device as claimed in claim 1, wherein plural vibration parts each being the vibration part are formed on the upper surface side of the substrate, the first via hole is formed so as to share a part of each of vibration spaces respectively for the plural vibration parts, and plural second via holes each being the second via hole are formed from the intermediate surface, so as to correspond respectively to the plural vibration parts.

3. The piezoelectric thin film device as claimed in claim 1, wherein the second via hole is positioned, by at least 2 μm,

inside the first via hole when viewed in a vertical direction.

4. The piezoelectric thin film device as claimed in claim 1, wherein the second via holes has a depth of 10 μm to 150 μm.

5. A method of manufacturing a piezoelectric thin film device of any one of claims 1 to 4, wherein, when the vibration space in the substrate is formed, a first via hole is formed from a lower surface of a substrate material toward an upper surface thereof, so as to form a bottom surface of the first via hole at an intermediate position in the substrate, a second via hole is thereafter formed from the bottom surface toward the upper surface of the substrate material, to be positioned inside the first via hole when viewed in a vertical direction, and the intermediate surface is formed by such a part of the bottom surface that remains in the substrate material.

6. The method as claimed in claim 5, wherein the piezoelectric thin film device has plural vibration parts each being the vibration part, on the upper surface side of the substrate, the first via hole is formed to be shared by the plural vibration parts, plural second via holes each being the second via hole are formed from the bottom surface, so as to correspond respectively to the plural vibration parts.

7. The method as claimed in claim 5, wherein a SOI wafer is used as the substrate material, and the bottom surface of the first via hole is constituted by a part of an insulating layer thereof.

8. The method as claimed in claim 5, wherein the second via hole is formed by a deep reactive ion etching method.

9. (Added) The piezoelectric thin film device as claimed in claim 3, wherein the second via hole is positioned inside by a distance of 5 μm to 50 μm from a peripheral part of a bottom surface of the first via hole.

10. (Added) The piezoelectric thin film device as claimed in claim 1, wherein an insulating layer is formed between the upper surface of the substrate and the piezoelectric laminated structure, the vibration part includes a part of the insulating layer, and the insulating layer has a thickness of 0.3 μm to 0.5 μm.

11. (Added) The piezoelectric thin film device as claimed in claim 2, wherein a distribution of resonant frequencies of piezoelectric thin film resonators each corresponding to the respective plural vibration parts is within ±0.42%.

12. (Added) The method as claimed in claim 5, wherein, when forming the second via hole, photo-resist is coated on the bottom surface of the first via hole at a thickness of 0.5 μm to 4 μm, then the photo-resist is patterned by removing a part thereof corresponding to the vibration part, the vibration part being positioned inside by a distance of 2 μm or more from a peripheral part of a bottom surface of the first via hole, then the substrate material is etched with the patterned photo-resist

used as a mask.

13. (Added) The method as claimed in claim 12, wherein the vibration part is positioned inside by a distance of 5 μm to 50 μm from the peripheral part of the bottom surface of the first via hole.

14. (Added) The method as claimed in claim 6, wherein a distribution of resonant frequencies of piezoelectric thin film resonators each corresponding to the respective plural vibration parts is within $\pm 0.42\%$.